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Detailed Description of The Preferred Embodiment
Page 6 (Fig 2) and Page 7 (Fig 3) in yellow

increases the safety of the passengers onboard an aircraft but also enhances the safety of persons on the ground and protects significant edifices from pilot error and/or terrorism.

In conclusion, insofar as the patent applicants are concerned, no other aircraft remote pilot capability formerly developed provides the necessary safeguards and capabilities to allow the dynamic transfer of the piloting function between the onboard pilot(s) and the ground-based remote pilot(s) for the control of Executive (small to medium sized) Aircraft, Passenger/Carrier Aircraft, Cargo Aircraft and large Military Aircraft. SAFELANDER permits aircraft, such as the above, to be operated remotely and safely in highly congested airspace. It also permits these aircraft to be safely piloted by a single onboard pilot should that mode of operation be selected. SAFELANDER substantially reduces the cost of flying and the cost of providing national and aviation security while enhancing aviation safety.

SUMMARY

The invention permits the safe landing of an aircraft equipped with a flight control unit, instrument landing system and autopilot by a remote pilot, located on the ground in a high fidelity virtual reality simulator. The invention has significant cost, security and safety advantages over the present method of controlling large Military, Executive (small to medium sized) Aircraft, Passenger/Carrier Aircraft, and Cargo Aircraft. It saves the cost of putting armed sky-marshals aboard commercial aircraft, eliminates the need for, and concomitantly safety and security problems associated with, allowing guns aboard commercial aircraft. SAFELANDER increases safety and security by providing a safer, more humane, more effective, less costly and quicker response time in altering a deviant aircraft's flight trajectory as compared to having an armed fighter aircraft intercept and possibly shoot down the deviant aircraft.

Accordingly several objectives and advantages of the invention are to provide a means of increasing aircraft in-air safety, on-ground safety, and security. Also SAFELANDER significantly lowers the overall cost of air travel by minimizing the cost of flight security as well as aircraft cost, fuel and piloting. Still further objectives and advantages of this invention will become apparent from a study of the following description and accompanying drawings.

computer capability necessary to control a high fidelity, virtual reality, cockpit environment, with or without a synthetic vision display. Also simulator 7 receives the air traffic control/management data (ATC/M), and if available weather, map and terrain data and security data 4 over the secure ground ciphered two way digital data link 5. A subset of the digital data transmitted/received over Link 5 can also be transmitted /received by aircraft 2 via global ciphered communication digital data link 1. The remote pilot in simulator 7 can communicate directly with aircraft 2 via ground link 5's interface to the global communication link 1.

FIG. 2 shows the SAFELANDER AVIONICS SYSTEM. Aircraft 2 is fitted to receive GPS/GLONASS Satellite 9 signals. The aircraft 2 has onboard a Global Positioning System/ Global Navigation Satellite System (GPS/GLONASS) Receiver 10 to accept 3-dimensional (Latitude, Longitude and Altitude) position data as well as 3-dimensional (North/South, East/West and Vertical) velocity data. Aircraft 2 also has a plurality of monitored performance and control flight signals going to the aircraft's flight control unit, instrument landing system, flight data recorders, autopilot, etc. These performance and control sensor data 11 signals are sent to a sensor multiplexer transceiver 12 for ciphered telemetry to the ground-based aircraft simulator 7. Since there exists a plurality of aircraft 2, each targeted aircraft has a unique identification (ID). The sensor multiplexer transceiver 12 of each specific/unique aircraft uses its unique ID to recognize and utilize only the information being specifically transmitted to the targeted aircraft as its designated data from the antenna 8 (in Fig. 3) of the CGBS. In a similar manner when a specific aircraft transmits its data to the antenna 8 (in Fig. 3) of the CGBS, the sensor multiplexer transceiver 12 adds its unique aircraft identification (ID) to the data stream in order to enable the CGBS to parse the data stream and to recognize that it is from each specific/unique aircraft. The signals are used in the simulator 7 to duplicate aircraft 2's environment. Also shown is the Remote Pilot Electronic Interface 13 that is used to accept signals from the remote pilot in the ground-based simulator 7 to allow for the remote piloting of aircraft 2. It accomplishes this by interfacing with the Flight Control Unit (FCU), Instrument Landing System (ILS) and Autopilot 13 of aircraft 2. For planes equipped with video data 14 this data is also transmitted to the ground-based simulator 7 for situation awareness. Aircraft acoustic data 15 is also transmitted from the aircraft 2 to the simulator 7. An advisory system 16 is shown situated in the cockpit of the aircraft 2 to provide both display and keyboard entry

communication between the simulator 7 and the aircraft 2. Also shown in FIG.2 is the Global Communication Link 1 for providing ciphered telemetry between the aircraft 2 and the simulator 7.

FIG. 3 shows the CENTRAL GROUND-BASED PROCESSING STATION (CGBS) used for collecting and disseminating the digital data from a plurality of aircraft and aviation sources. The CGBS digitally processes such sources and then ciphers the digital data so that it can be exclusively/uniquely/solely utilized by the targeted aircraft 2. It also shows the antenna 8 utilized for transmitting and receiving radio frequency (RF) ciphered two-way digital data between the CGBS and the targeted aircraft 2. Since there exists a plurality of aircraft 2, each targeted aircraft has a unique identification (ID) that permits the CGBS to process each individual aircraft 2 as a unique vehicle. The CGBS, by adding the unique aircraft ID to its transmitted data stream, can send data to a specific/unique aircraft, or send a general message to a group of aircraft, or a global message to all aircraft. To assure the integrity, security and uniqueness of critical digital data going to and from all aircraft 2 the antenna control and RF interface 23 perform the cipher/decipher, anti-jam and anti-spoof controller functions. All of the communication both to and from the aircraft 2 and other aircraft are stored in the data storage 18 section of the CGBS for archival retrieval should that become necessary for post flight analysis. The CGBS also acts as the communication control unit for the air traffic control/management (ATC/M) module 19 data and the Air Carrier and Aircraft Manufacturers Communication Module 20. In order for the CGBS to process the large amount of digital data, communication and ciphering information a processor 21 acts as an intelligent controller. The CGBS provides visibility to the many transactions taking place at this site via a display and control system 22. The Remote Pilot Simulator 7 communicates with aircraft 2 though the ATC/M Module 19. The Remote Pilot Simulator 7 communication to/from ATC/M Module 19, with aircraft 2 includes the aircraft control parameters (e.g.: aircraft ID, 3-D position, 3-D velocity, heading, velocity, target state and target change reports – waypoints, etc.) via the secure ground digital data 5. The ATC/M. weather, map, terrain and security communication 4 from the ATC/M Module 19 is transmitted/received over the secure ground digital data link 5. The ATC/M 19 and aircraft data from a plurality of CGBS' is also distributed over the secure ground digital data link 5.

FIG. 4 shows the GROUND-BASED DATA DISTRIBUTION SYSTEM. The processor 21 integrates the Air Traffic Control/Management (ATC/M) module 19 with the Air Carrier and